

C L A I M S

1. A surface shape recognition sensor device
2 characterized by comprising:
3 a plurality of detection elements which are
4 two-dimensionally arranged;
5 a first detection electrode which is included
6 in each detection element and comes into contact with an
7 object through an insulating film to generate a
8 capacitance corresponding to a three-dimensional pattern
9 of a surface shape of the object;
10 a second detection electrode which is included
11 in each detection element and comes into electrical
12 contact with the detection element;
13 a surface shape detection unit which detects
14 the three-dimensional pattern of the surface shape as an
15 output from said detection element on the basis of the
16 capacitance obtained through said first detection
17 electrode of said detection element; and
18 a biometric recognition unit which determines
19 whether the object is a living body, on the basis of a
20 signal corresponding to an impedance of the object
21 connected between said second detection electrodes
22 included in at least a first detection element and
23 second detection element of said detection elements,
24 wherein said second detection electrode of
25 said first detection element is connected to a
26 predetermined common potential, and said second

27 detection electrode of said second detection element is
28 connected to said biometric recognition unit.

2. A surface shape recognition sensor device
2 according to claim 1, characterized by further
3 comprising a third detection element which is arranged
4 between said first detection element and said second
5 detection element and has said first detection electrode
6 connected to said surface shape detection unit and said
7 second detection electrode set in a high-impedance
8 state.

3. A surface shape recognition sensor device
2 according to claim 2, characterized by further
3 comprising a switch which is connected between the
4 common potential and said second detection electrode of
5 said third detection element to disconnect said second
6 detection electrode from the common potential when said
7 biometric recognition unit executes biometric
8 determination of the object and short-circuit said
9 second detection electrode to the common potential when
10 said surface shape detection unit detects the surface
11 shape.

4. A surface shape recognition sensor device
2 according to claim 1, characterized by further
3 comprising a third detection element which is arranged
4 between said first detection element and said second
5 detection element, has said first detection electrode
6 connected to said surface shape detection unit and said

7 second detection electrode connected to the common
8 potential, and includes an insulating film which
9 insulates said second detection electrode from the
10 object.

5. A surface shape recognition sensor device
2 according to claim 1, characterized by further
3 comprising a switch which is connected between said
4 biometric recognition unit and said second detection
5 electrode of said second detection element to
6 selectively connect said second detection electrode to
7 said biometric recognition unit when said biometric
8 recognition unit executes biometric determination of the
9 object and selectively connect said second detection
10 electrode to the common potential when said surface
11 shape detection unit detects the surface shape.

6. A surface shape recognition sensor device
2 according to claim 2, characterized by further
3 comprising
4 a band-shaped second detection region which
5 includes a plurality of second detection elements
6 arranged adjacent to each other and is arranged to cross
7 a center of the detection surface,
8 two band-shaped third detection regions which
9 include a plurality of third detection elements arranged
10 adjacent to each other and are arranged on both sides of
11 said second detection region, and
12 two band-shaped first detection regions which

13 include a plurality of first detection elements arranged
14 adjacent to each other and are arranged outside said
15 third detection regions.

7. A surface shape recognition sensor device
2 according to claim 2, characterized by further
3 comprising
4 a second detection region which includes a
5 plurality of second detection elements arranged adjacent
6 to each other and is arranged at a center of the
7 detection surface,
8 a third detection region which includes a
9 plurality of third detection elements arranged adjacent
10 to each other and is arranged to surround an entire
11 periphery of said second detection region, and
12 a first detection region which includes a
13 plurality of first detection elements arranged adjacent
14 to each other and is arranged to surround an entire
15 periphery of said third detection region.

8. A surface shape recognition sensor device
2 according to claim 1, characterized by further
3 comprising
4 a band-shaped second detection region which
5 includes a plurality of second detection elements
6 arranged adjacent to each other and is arranged to cross
7 a center of the detection surface, and
8 two band-shaped first detection regions which
9 include a plurality of first detection elements arranged

10 adjacent to each other and are arranged on both sides of
11 said second detection region.

9. A surface shape recognition sensor device
2 according to claim 1, characterized by further
3 comprising
4 a second detection region which includes a
5 plurality of second detection elements arranged adjacent
6 to each other and is arranged at a center of the
7 detection surface, and
8 a first detection region which includes a
9 plurality of first detection elements arranged adjacent
10 to each other and is arranged to surround an entire
11 periphery of said second detection region.

10. A surface shape recognition sensor device
2 according to claim 1, characterized in that said
3 biometric recognition unit comprises
4 a response signal generation unit which
5 applies a predetermined supply signal to said detection
6 element and outputs, as a response signal, a signal
7 whose phase and amplitude have changed in accordance
8 with an impedance of the object which is in contact
9 through said detection element,
10 a waveform information detection unit which
11 detects, as waveform information, one of the phase and
12 amplitude representing a waveform of the response signal
13 and outputs a detection signal representing the waveform
14 information, and

15 a biometric determination unit which
16 determines on the basis of the waveform information
17 contained in the detection signal whether the detection
18 signal is a living body.

 11. A surface shape recognition sensor device
2 characterized by comprising:

3 a plurality of capacitance detection units
4 which are arranged in a grid shape to cause a detection
5 element to detect a capacitance generated with respect
6 to an object and output a capacitance signal
7 representing a value of the capacitance;

8 detection elements which are arranged near
9 said capacitance detection units;

10 a plurality of control lines which connect, of
11 said capacitance detection units, capacitance detection
12 units arranged in a column direction;

13 a plurality of data lines which connect, of
14 said capacitance detection units, capacitance detection
15 units arranged in a row direction;

16 a column selector which sequentially selects
17 one of said control lines to select each capacitance
18 detection unit connected to said control line;

19 a first A/D conversion unit which is arranged
20 for each data line and A/D-converts the capacitance
21 signal, which is output from each capacitance detection
22 unit selected by said column selector to said data line,
23 into three-dimensional data and outputs the

24 three-dimensional data;
25 a row selector which sequentially selects the
26 three-dimensional data obtained from said first A/D
27 conversion unit for each data line and outputs the
28 three-dimensional data as surface shape data
29 representing a surface shape of the object;
30 an impedance detection unit which is arranged
31 together with a detection element as a pair in place of
32 one of said capacitance detection units and comes into
33 electrical contact with the object through said
34 detection element to detect an impedance of the object
35 and outputs a detection signal corresponding to the
36 impedance; and
37 a biometric determination unit which
38 determines on the basis of the detection signal from
39 said impedance detection unit whether the object is a
40 living body,
41 wherein said biometric recognition unit
42 comprises a response signal generation unit which
43 applies a predetermined supply signal to said detection
44 element and outputs, as a response signal, a signal
45 whose phase and amplitude have changed in accordance
46 with an impedance of the object which is in electrical
47 contact through said detection element, and a waveform
48 information detection unit which detects, as waveform
49 information, one of the phase and amplitude representing
50 a waveform of the response signal and outputs a

51 detection signal representing the waveform information,
52 and
53 said biometric determination unit executes
54 determination on the basis of whether the waveform
55 information contained in the detection signal falls
56 within a reference range of the waveform information
57 which indicates an authentic living body.

12. A surface shape recognition sensor device
2 according to claim 11, characterized by further
3 comprising
4 an individual control line which is connected
5 to said impedance detection unit,
6 an individual data line which is connected to
7 said impedance detection unit,
8 a control unit which selects said impedance
9 detection unit by selecting said individual control
10 line, and
11 a second A/D conversion unit which outputs, as
12 determination data, the waveform information contained
13 in the detection signal output from said impedance
14 detection unit to said individual data line,
15 wherein said impedance detection unit outputs
16 the detection signal representing the waveform
17 information corresponding to the impedance of the object
18 to said individual data line in accordance with
19 selection by said control unit through said individual
20 control line, and

21 said biometric determination unit executes
22 determination on the basis of the waveform information
23 contained in the determination data from said second A/D
24 conversion unit.

13. A surface shape recognition sensor device
2 according to claim 11, characterized by further
3 comprising

4 an individual control line which is connected
5 to said impedance detection unit, and

6 a control unit which selects said impedance
7 detection unit by selecting said individual control
8 line,

9 wherein said impedance detection unit is
10 connected to one of said data lines and outputs the
11 detection signal representing the waveform information
12 corresponding to the impedance of the object to said
13 data line in accordance with selection by said control
14 unit through said individual control line, and

15 said biometric determination unit executes
16 determination on the basis of the waveform information
17 contained in determination data which is obtained by
18 causing said first A/D conversion unit to A/D-convert
19 the detection signal output to said data line.

14. A surface shape recognition sensor device
2 according to claim 11, characterized in that

3 said impedance detection unit is connected to
4 one of said control lines and one of said data lines and

5 outputs the detection signal to said data line in
6 accordance with selection by said selector, and
7 said biometric determination unit executes
8 determination on the basis of the waveform information
9 contained in determination data which is obtained by
10 causing said first A/D conversion unit to A/D-convert
11 the detection signal output to said data line.

15. A surface shape recognition sensor device
2 according to claim 11, characterized by further
3 comprising a plurality of said impedance detection units
4 which are arranged in place of different said
5 capacitance detection units.